HANDHELD ELECTRONIC DEVICE HAVING A FLEXIBLE DISPLAY

FIELD

[0001] This disclosure relates generally to handheld electronic devices and, more particularly, to handheld electronic devices having a flexible display.

BACKGROUND INFORMATION

[0002] Numerous types of handheld electronic devices are known. Examples of such handheld electronic devices include, for instance, personal data assistants (PDAs), handheld computers, two-way pagers, mobile telephones, and the like. Some handheld electronic devices feature wireless communication capabilities. Other handheld electronic devices are stand-alone devices that are functional without communication with other devices.

[0003] A typical handheld electronic device has a display supported by a housing. The display is generally a non-flexible component having fixed physical dimensions. In addition to the display, a typical handheld electronic device also includes an input portion including a keyboard, keypad, touchpad, gamepad, touchscreen, or a combination of such input devices.

[0004] Certain devices benefit from a large display area, but have a correspondingly large overall size. In attempts to provide a more compact and portable design, some handheld electronic devices have incorporated a flexible display permitting a certain amount of bending of the device. With advances in flexible displays, the minimum bend radiuses of some of these flexible displays have been reduced so that the flexible displays can be folded when a handheld electronic device is closed.

[0005] Even when using some of the most advanced flexible displays, there are limits on the extent to which displays can be folded. In some instances, a small bend radius can result in a region of high mechanical stress causing delamination and/or failure of the flexible display.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate several embodiments and, together with the description, serve to explain the disclosed principles. In the drawings:

[0007] FIG. **1** is a side view of a handheld electronic device in a closed configuration, consistent with disclosed embodiments;

[0008] FIG. **2** is a perspective top view of a handheld electronic device in an open configuration, consistent with disclosed embodiments;

[0009] FIG. **3**A is a side view of a handheld electronic device in a closed configuration, according to a first exemplary embodiment;

[0010] FIG. **3**B is a side view of the handheld electronic device of FIG. **3**A in an open configuration with an input portion in a first position;

[0011] FIG. **3**C is a side view of the handheld electronic device of FIG. **3**A in an open configuration with the input portion in a second position;

[0012] FIG. **4**A is a side view of a handheld electronic device in a closed configuration, according to a second exemplary embodiment;

[0013] FIG. **4**B is a side view of the handheld electronic device of FIG. **4**A in an open configuration with an input portion in a first position;

[0014] FIG. **4**C is a side view of the handheld electronic device of FIG. **4**A in an open configuration with the input portion in an intermediate position between the first position and a second position; and

[0015] FIG. **4**D is a side view of the handheld electronic device of FIG. **4**A in an open configuration with the input portion in the second position.

DETAILED DESCRIPTION

[0016] Reference will now be made in detail to exemplary embodiments, examples of which are illustrated throughout the drawings. Wherever possible, the same reference numbers are used in the drawings and the description to refer to the same or like parts.

[0017] The disclosure generally relates to a handheld electronic device. Examples of handheld electronic devices include mobile wireless communication devices such as pagers, mobile phones, mobile smart-phones, wireless organizers, personal digital assistants, wireless-enabled notebook computers, and any other known communication device.

[0018] An exemplary handheld electronic device **10** is illustrated in FIGS. **1** and **2**. As shown in these figures, handheld electronic device **10** is of the "flip" or "foldable" variety which, as will be described below, refers to the ability of the device to be translated between a closed configuration (FIG. **1**) and an open configuration (FIG. **2**). Handheld electronic device **10** includes a housing **20**, a flexible display **22**, and an input portion **24**.

[0019] Housing **20** has a first housing portion **20***a*, a second housing portion **20***b*, and a flexible housing portion **20***c* between first housing portion **20***a* and second housing portion **20***b*. As shown in FIG. **1**, first housing portion **20***a* is substantially parallel to second housing portion **20***b*, when handheld electronic device **10** is in the closed configuration. As shown in FIG. **2**, first housing portion **20***a* and second housing portion **20***b* are aligned in the same plane so as to provide a substantially flat arrangement when handheld electronic device **10** is in the open configuration.

[0020] Flexible housing portion **20***c* connects first housing portion **20***a* and second housing portion **20***b* to one another. Flexible housing portion **20***c* is comprised of flexible material and configured to provide a flexible hinge. On application of a force by a user of handheld electronic device **10**, second housing portion **20***b* is movable, relative to first housing portion **20***a*, about flexible housing portion **20***c* to translate electronic handheld device **10** from the closed configuration (FIG. **1**) to the open configuration (FIG. **2**), and vice versa. In some embodiments, flexible housing portion **20***c* includes stiffening ribs **38** to control the bend radius of housing **20** in the closed configuration. Ribs **38**, or other structures, also maintain first housing portion **20***a* and second housing portion **20***b* in the substantially flat arrangement in the open configuration.

[0021] Flexible display **22** is associated with housing **20**. Flexible display **22** includes a flexible organic light-emitting diode (OLED) display, a flexible e-ink display, a flexible liquid crystal display (LCD), or another type of flexible display. In some embodiments, flexible display **22** is a touch screen display.

[0022] Flexible display **22** is disposed on a front face **30** of housing **20**, and extends across first housing portion **20***a*,